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needed as the digital computer will compare the ratio of the two RMS values with the limit value. These relationships are shown in FIG. 3 which is a plot of various RMS ratios designated as A, B and C, and they are plotted against time. The top line 53 represents the limit value for a given M_∞ , h_∞ , and arrow 55 represents the difference between RMS ratio C and limit value 53. When the computed RMS ratio equals the limit value, the operating point of the fan is changed, as is described below.

Returning to FIG. 2, the output of circuit 51 is fed to control 54 for altering the operating point of the fan. The fan operating point can be changed in three manners, i.e., by changing the nozzle area of the jet engine, changing the fan speed, and changing the flight altitude h_∞ and the Mach number M_∞ . Changing one (or more) of the above three items is dependent on the other two. The means for controlling the nozzle area, fan speed, flight mach number and flight altitude are well known in presently used jet control systems; as for example, the F100 and F401 jet engines. These means have been used for many years by the large jet engine manufacturers. Changing the operating point of the fan is shown schematically in FIG. 4 which is a fan map showing the relationship of pressure ratio to flow. Line 57 is the steady-state clean operating line and line 59 is the clean surge line. Line 61 is a line of constant speed. The points A, B, C, D and E are possible operating points. Point C denotes a point near surge and by altering the nozzle area, or the fan speed, or M_∞ and h_∞ , the operating point of a fan can be changed from point C to point D, point E, point B, or point A.

All of the elements of this invention are well known in the art and are readily available usually as off-the-shelf items.

What is claimed is:

1. A system for automatically avoiding a surge of a jet engine having a fan with an entry plane and a discharge plane, comprising:

- a. a first time variant total pressure probe positioned at the entry plane of the jet engine fan;

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- b. a second time variant total pressure probe positioned at the discharge plane of the jet engine fan;
- c. first and second means for converting responses of the first and second pressure probes respectively into corresponding electrical signals;
- d. first and second RMS meters fed respectively by the first and second converting means;
- e. a computer fed by the first and second RMS meters for determining the ratio of the outputs of second RMS meter to the first RMS meter;
- f. a threshold circuit fed by the computer wherein the ratio of the outputs of the first and second RMS meters is compared with a predetermined limit value; and
- g. means for controlling the operating point of the fan.

2. A system for automatically avoiding a surge of a jet engine according to claim 1 wherein the first and second converting means are pressure-to-electrical transducers.

3. A system for automatically avoiding a surge of a jet engine according to claim 2 which further comprises first and second filters interposed between the first and second pressure-to-electrical transducers and the first and second RMS meters respectively.

4. A system for automatically avoiding a surge of a jet engine according to claim 3 which further comprises first and second analog-to-digital converters interposed one each between the computer and the first and second RMS meters respectively, and wherein the computer is a digital computer.

5. A system for automatically avoiding a surge of a jet engine according to claim 3 wherein the means for controlling the operating point of the fan is a means for controlling the nozzle area of the jet engine.

6. A system for automatically avoiding a surge of a jet engine according to claim 3 wherein the means for controlling the operating point of the fan is a means for controlling the speed thereof.

7. A system for automatically avoiding a surge of a jet engine according to claim 3 wherein the means for controlling the operating point of the fan is a means for controlling the flight altitude and Mach number.

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